



From **Sizzling Hot BBQ** to **Cool** BUD-Lite

Taming the Grid Dish for Space Communications

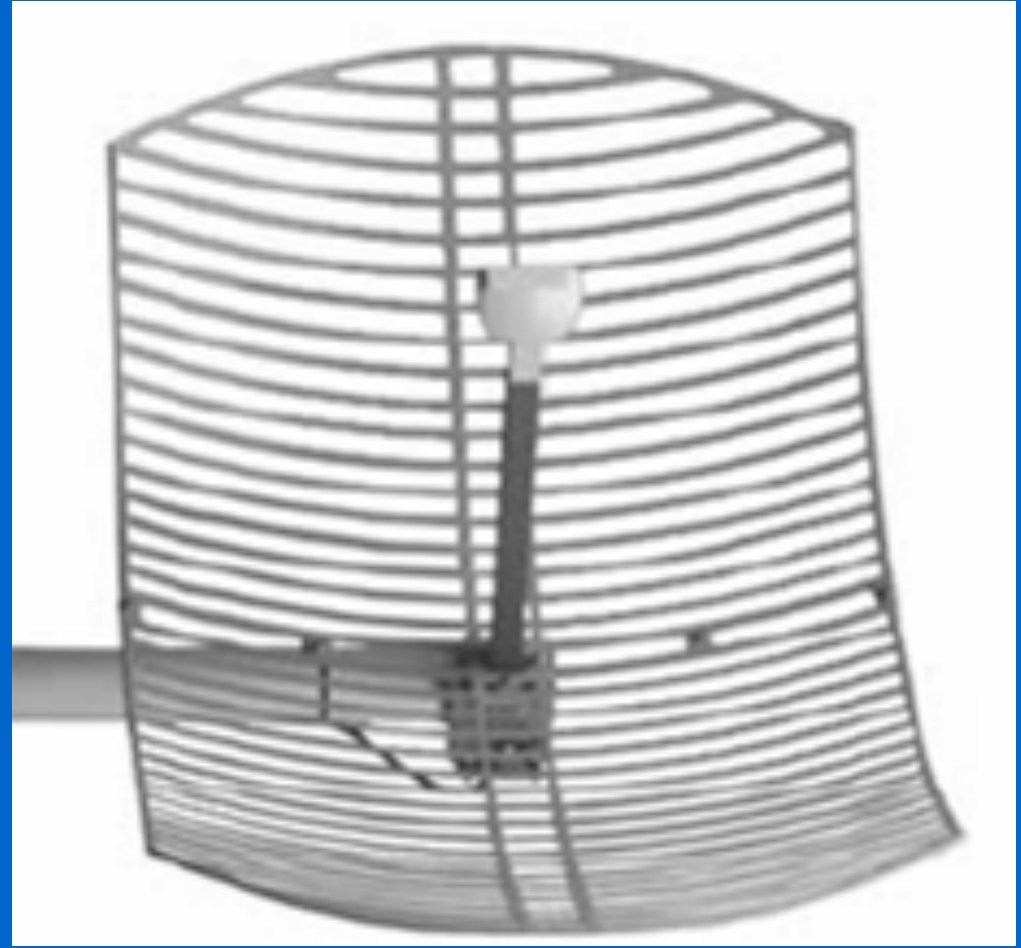


Anthony Monteiro, AA2TX
AMSAT Space Symposium, 2004

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The BBQ-Grill Antenna

- **S-Band**
- **3' x 2' parabolic grid reflector**
- **Dipole feed**
- **24 dBi gain**
- **Readily available**
- **Light-weight**
- **Cheap!**



Highly Controversial

- Prior to launch of P3D (AO-40) considered to be ideal for receiving S-band when paired with Drake down-converter
- *Back-of-the-envelope* analysis shows it should work pretty well
- *One-the-air* performance on AO-40 seemed a lot worse than expected
- Why?

Visit to the On-line Hamfest

NetCaptor

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PACIFIC WIRELESS DC24 24DBI GRID ANTENNA NEW Item number: 5716122844

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Starting bid: **US \$48.00**

Place Bid >

Time left: **5 days 15 hours**
7-day listing
Ends Aug-26-04 11:41:51 PDT
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Start time: Aug-19-04 11:41:51 PDT

History: [0 bids](#)

~~Buy it Now~~ Price: **US \$50.00**

Buy It Now >

Item location: St. Louis, MO 314-918-7526
United States / St. Louis

Ships to: United States only

[Shipping and payment details](#)

Description (revised)

PAWDC24
24dBi

Seller Information

[rod40](#) (4478 ★) **new**

Feedback Score: 4478
Positive Feedback: 99.8%
Member since Oct-08-98 in United States
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eBay Item 5716122844 (Ends Aug-26-04)

start Firefox Pro ... NetCaptor Microsoft Po... My Pictures buidlesFinal.... 11:23 PM

Low-Noise Test Receive System

- DEM 13ULNA Preamp
- AIDC-3731AA Downconverter
- Step Attenuator
- Yaesu FT-817 (AGC off)
- Hewlett-Packard AC Voltmeter
- Monitor Speaker

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Baseline Performance Test

- AO-40 at 62,067 km
- Squint 5.5 degrees
- Beacon measured 15.5dB (S+N)/N
- Use ao40v2.1.xls (Gene Marcus)
- Antenna temp = *Sizzling Hot* 156 K

Why is this BBQ-Grill so hot?

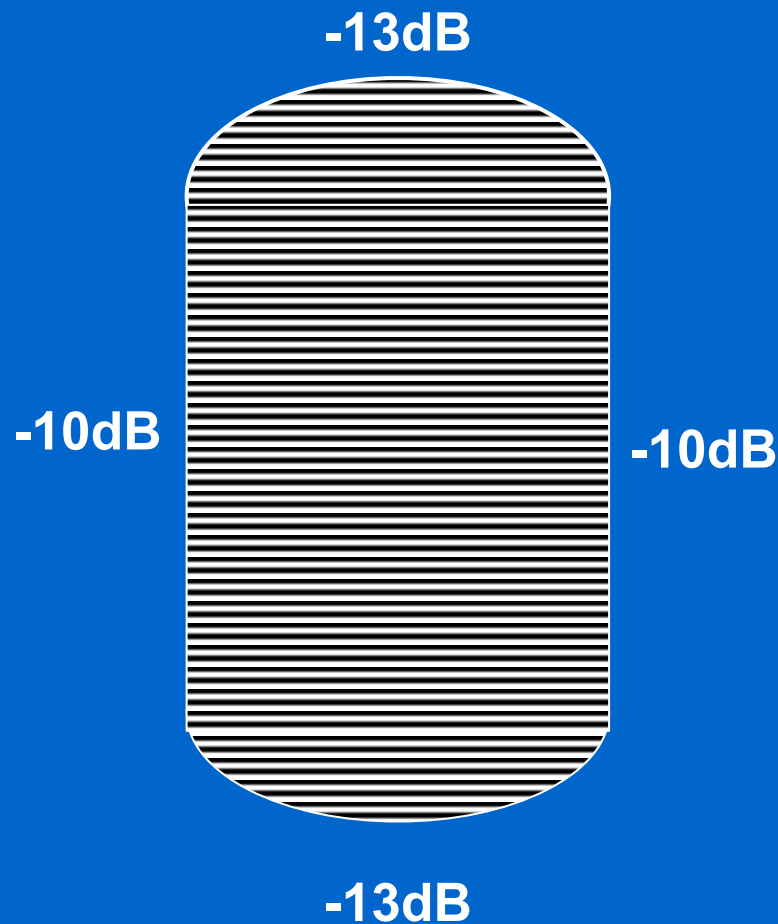
- **NX7U NEC model – dipole feed over-illuminates the dish**
- **EZNEC model confirmed**
- **No easy way to fix dipole feed**
- **Need a better feed**

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Pyramidal Horn Feed

- **Easy to construct**
- **Easy to control radiation pattern**
- **BBQ Dish is not symmetrical - what illumination pattern should we use?**

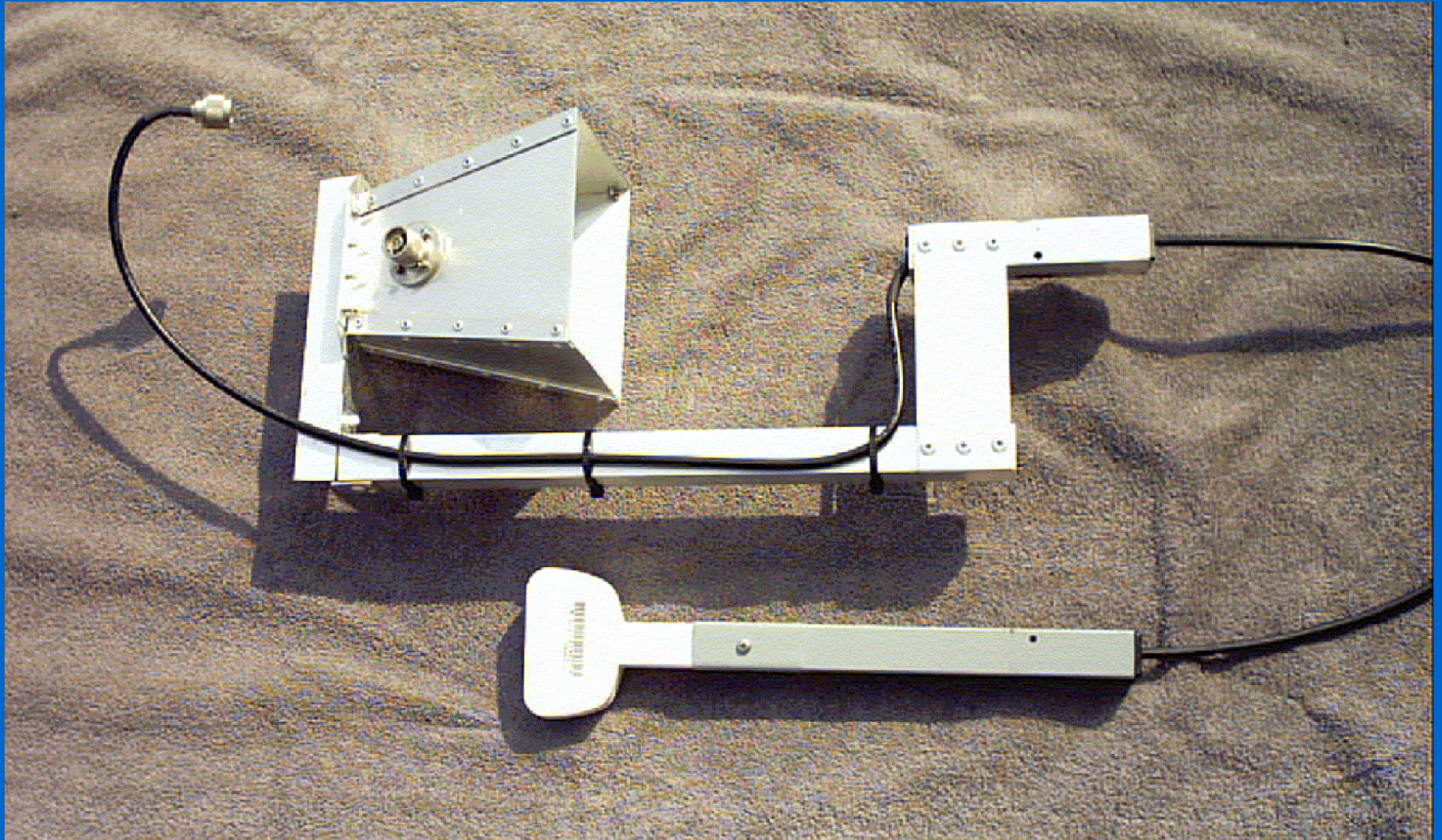
Illumination Pattern – Compromise



- **-13dB on top and bottom edges for best S/N**
- **-10dB on sides prevents too much gain loss**
- **Additional feed shielding may be needed for best performance**

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Pyramidal Horn Feed



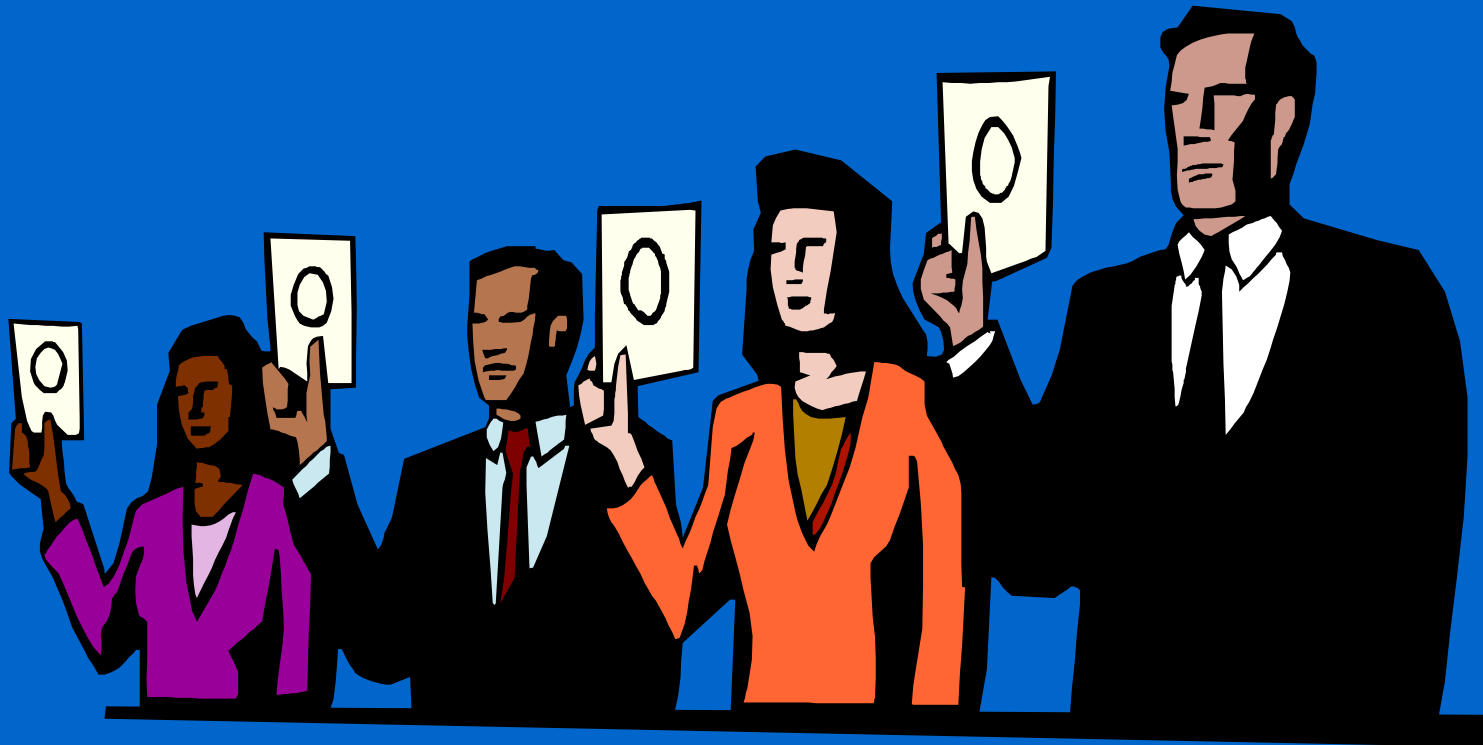
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Sun Noise Measurements

- **Easy way to compare antenna performance**
- **Point dish straight up - measure noise**
- **Point dish at the sun – measure increase in noise**
- **Greater sun noise = better performance**

Sun Noise Measurement

- Dipole Feed = 1.5 dB
- Horn Feed = 1.4 dB



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Sun Noise Measurements

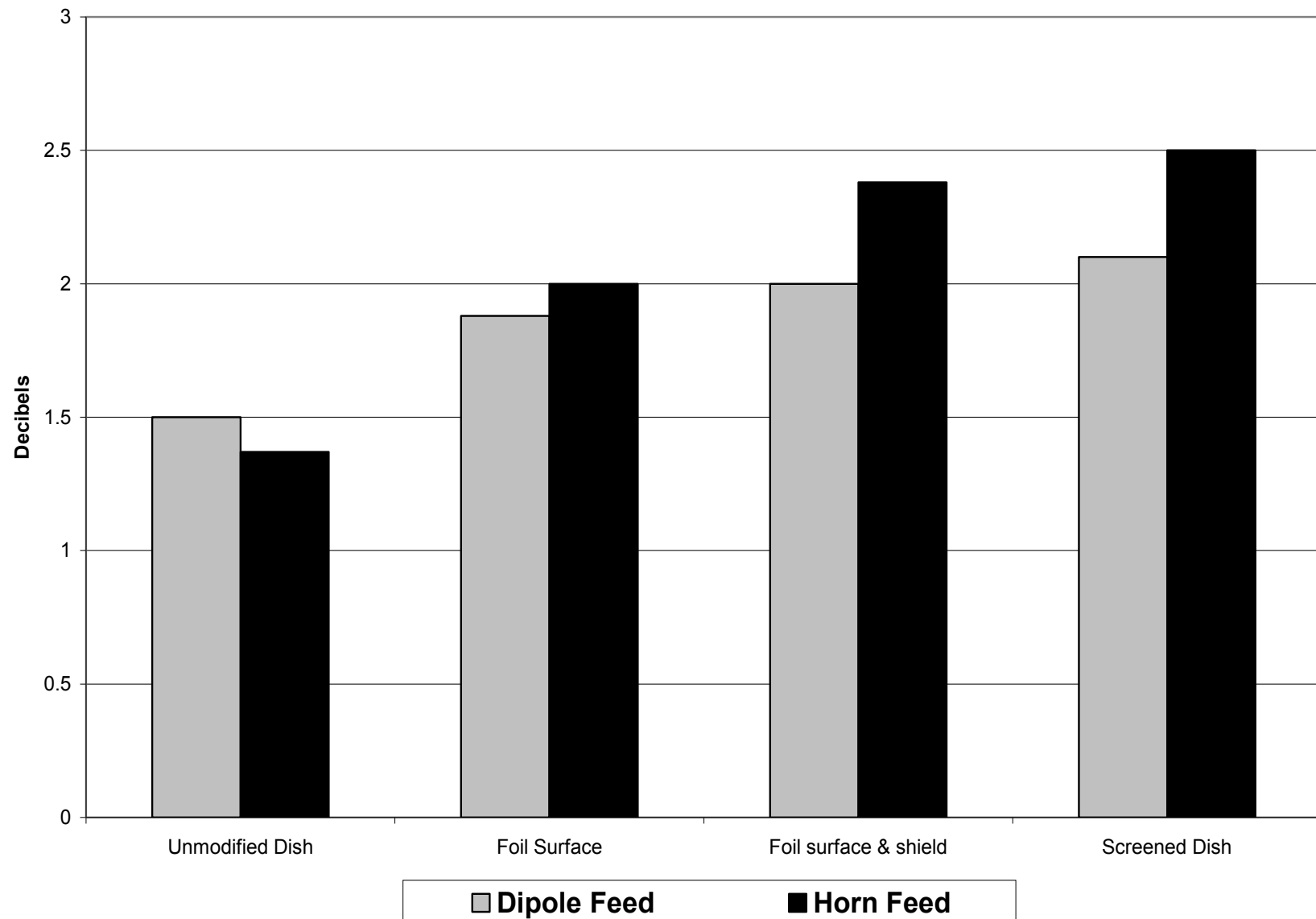
- **Horn feed should have performed better than dipole**
- **Feed over-illumination is not the only problem**
- **Must be some other source of noise**
- **What about the dish surface?**

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Dish Experiments

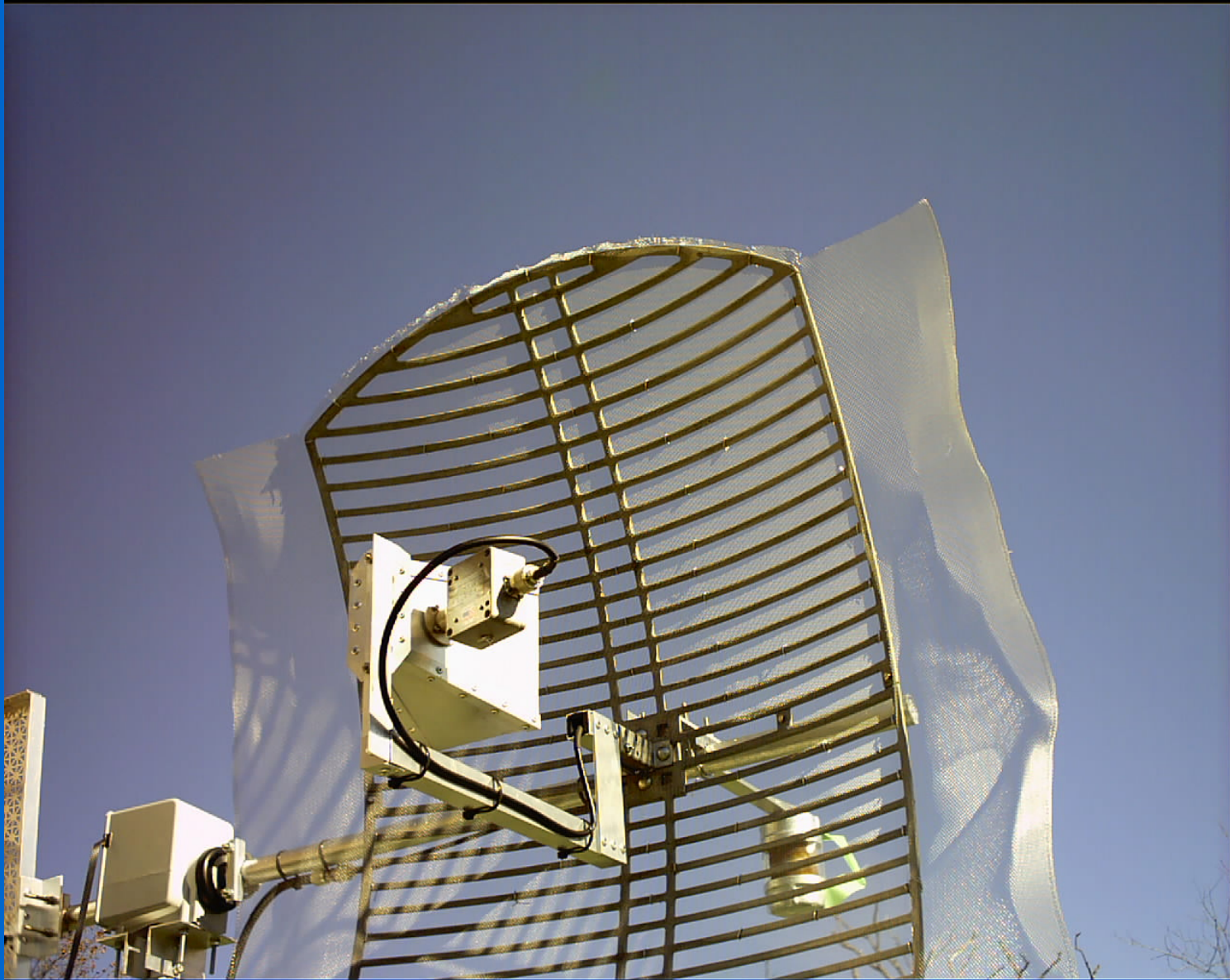
- **Cover dish surface with aluminum foil**
- **Add aluminum foil “thermal shields” to sides of dish**
- **Repeat using aluminum window screening instead of foil**

Sun Noise Measurements



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Horn Mounted to Screened Dish



Screened Dish Performance Test

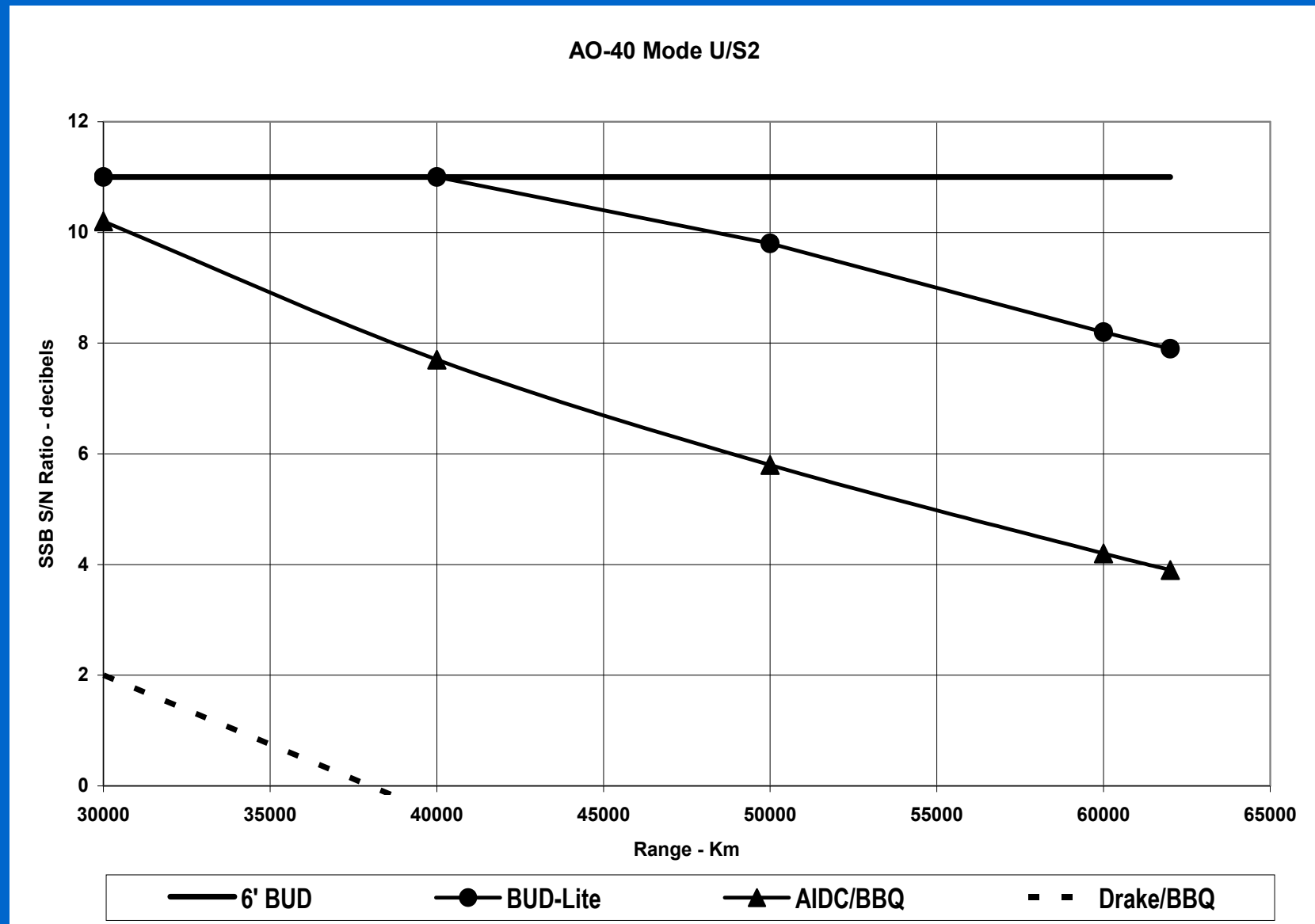
- AO-40 at 60,364 km
- Squint 12.6 degrees
- Horn feed
- Beacon measured 18.5 dB (S+N)/N
- Antenna temp = 50 K (vs 156 K)
- Noise temp reduced by > 100 K
 - difference between boiling water and ice!

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Calculated System Comparisons

- 1. 6' BUD, AIDC-3731AA**
- 2. Basic BBQ dish, Drake converter**
- 3. Basic BBQ dish, AIDC-3731AA**
- 4. Modified BBQ Dish, low noise preamp**

System Performance Comparisons



BBQ-Grill Dish - Modifications

- Aluminum window screen
- Horn Feed
- Low-noise preamp
- On-the-air performance is very good and is close to a BUD
- Much smaller, lighter and costs a lot less

Cool BUD-Lite Antenna



- Questions?
- Thank You!

Cheap Mode U/S Antenna System



- Non-penetrating roof mount..... \$120
- Pair of TV antenna rotators..... \$ 70
- BBQ-Dish..... \$ 50
- Working lots of DX on HEO satellites.....

